OPTIMIZATION PARAMETER OF SURFACE ROUGHNESS FOR AISI 1018 LOW CARBON STEEL USING BORON INSERT IN WET TURNING PROCESS

MUHAMMAD HANIF BIN LAPATELO

B071510704

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2018

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

OPTIMIZATION PARAMETER OF SURFACE ROUGHNESS FOR AISI 1018 USING BORON INSERT IN WET TURNING PROCESS

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

by

MUHAMMAD HANIF BIN LAPATELO

B071510704

950626-12-5585

FACULTY OF ENGINEERING TECHNOLOGY

2018

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Optimization Parameter of Surface Roughness for AISI 1018 Low Carbon Steel Using Boron Insert in Wet Turning Process**

SESI PENGAJIAN: **2018/2019 Semester 1**

Saya **MUHAMMAD HANIF BIN LAPATELO**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	TIDAK TERHAD	

Disahkan oleh:

_____ _____

Alamat Tetap:
No 13383, Lorong 6, Bandar Sri
Indah, 91000 Tawau,
Sabah.

Cop Rasmi:

Tarikh: _____ Tarikh: _____

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled “Optimization Parameter of Surface Roughness for AISI 1018 Low Carbon Steel using Boron Insert in Wet Turning Process” is the results of my own research except as cited in references.

Signature	:	…….
Author’s Name	:	Muhammad Hanif Bin Lapatelo
Date	:	……

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process & Technology) with Honors. The member of the supervisory is as follow:

……

(Project Supervisor)

DEDICATION

A special appreciation, I dedicate this thesis to my mother Martina Binti Talud, my father Lapatelo Bin Larose

ABSTRAK

Kajian ini dijalankan untuk menentukan parameter optimum untuk Kekasaran Permukaan dalam Proses Larik AISI 1018 Keluli Karbon Rendah menggunakan mata alat pemotong keluli Boron dan dikaji menggunakan kaedah Taguchi. Objektif projek ini adalah untuk mencari parameter optimum proses larik dalam menghasilkan kekasaran permukaan yang baik. Kelajuan pemotongan yang dipilih untuk proses larik adalah 400, 450 dan 500rpm. Parameter kadar suapan adalah 0.04, 0.06 dan 0.08mm/rev. Berikut adalah parameter ketiga yang akan dipertimbangkan dalam projek ini ialah corak tekstur pada alat pemotongan keluli boron iaitu gerhana, beralun dan berserenjang. Proses pemesinan larik akan dilakukan pada mesin larik CNC. Juga, proses pemesinan tekstur pada alat pemotong keluli boron akan dilakukan dengan menggunakan Mesin Laser CNC. Kekasaran permukaan akan diuji dengan menggunakan Permukaan Kekasaran Peguji Mitutoyo SJ-410. Faktor utama yang memberikan impak dalam kekasaran permukaan ialah kelajuan pemotongan dengan nilai 47.17% dikaji melalui ANOVA.

ABSTRACT

This research was carried out to determine the Optimization Parameter of Surface Roughness in Turning Process of AISI 1018 Low Carbon Steel using Boron Steel and analyse by using Taguchi method. The objectives of this project are to find the optimum parameter of turning process in producing good surface roughness. The selected spindle speed for turning process are 400, 450 and 500rpm. The feed rate parameters 0.04, 0.06 and 0.08mm/rev. Next the third parameters that will be considered in this project are the texture pattern on Boron Steel cutting tool which are eclipse, wavy and perpendicular. Machining process of turning will be performed on the CNC Turning machine. Also, the machining process of engraving the texture on Boron Steel cutting tool will be performed with using CNC Laser machine. The surface roughness will be test by using Surface Roughness Tester Mitutoyo SJ-410. The significant factor that impact the surface roughness is the spindle speed which is 47.17 % analysed by ANOVA.

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim.

Thanks to Allah SWT, whom with His wiling giving me the opportunity to complete this Final Year Project 2.

Firstly, I would like to express my deepest thanks to my Mr. Mohd Hairizal Bin Osman, a lecturer at Universiti Teknikal Malaysia Melaka (UTeM) and also assign as my supervisor who had guided me in a lot of task. Also, I would like to thanks to Mr. Muhammad Syafik Bin Jumali, Mr. Mohamad Ridzuan Bin Mohamad Kamal, Mr. Basri Bin Bidin, Mr. Azimin Bin Ibrahim, Mr. Norhisham Bin Abdul Malik and all the lecturer and UTeM staff and who had been involved directly or indirectly through out this process.

Deepest thanks and appreciation to my beloved parents and family for their cooperation, encouragement and support for the report completion. Also, thanks to all my friends that have been contributed by supporting my work and help during the final year project till it is fully completed.

.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AISI	-	American Iron and Steel Institute
CNC	-	Computer Numerical Control
CO_2	-	Carbon Dioxide
DOF	-	Depth of Cut
f	-	Feed Rate
MQL	-	Minimum Quality Liquid
M	-	Molybdenum
pH	-	Potential of Hydrogen
R	-	Tool of Radius
S/N	-	Signal to Noise
T	-	Tungsten
Ra	-	Arithmetic Mean Surface Roughness
Rq	-	Root mean square
Rp	-	Maximum profile peak height
Rt	-	Total height of the roughness profile
Rz	-	Maximum height of the roughness profile
Rv	-	Maximum profile valley depth
Rc	-	Mean height of profile element
HRC	-	Rockwell C Hardness
HRB	-	Rockwell B Hardness

CHAPTER 1

INTRODUCTION

1.0 Introduction

Chapter one will cover about the introduction that consist of the project background, project background, problem statement, objectives and project scope.

1.1 Project Background

Boron steel usage to improve the strength of the motor vehicle is obviously in the motor industry that is. Nevertheless, in a growing safety conscious environment, which we can realize the enclosure of many new safety features, the available statistics must be study in order to get a better results. Latest outcomes must be able to handle the theory that the car-user accident rate has been reduced significantly in recent years and where it has, it is essential that what really lies behind the reduction is identified.

In manufacturing line, defect might be occur during manufacturing phase of product if the product differ from its actual planned design which can causes the unwanted defect part will be remove or become a reject part. So in this project, the cutting tool or insert that will be use in this experiment is Boron steel that taken from wastage of Proton Iriz car which is chassis part that has been the process of hot stamping. This Boron Steel is used to fabricate pattern cutting tool in this experiment by using Computer Numerical Control (CNC) Laser Machine. Every product that produce has their own life cycle, so do car. Car life cycle is begin and ends in a factory. In life-cycle assessment, the more material can be recycle the more better the product design can be. In this case, Boron steel that has end of life cycle can be reuse to produce the cutting tool. Hence, the cycle life of car will be improve.

Texture pattern will be perform on the Boron Steel by using the Computer Numerical Control (CNC) Laser Machine which call as an engraving process. The process is to remove a small amount on surface which is subset of laser marking and can produce line or texture on Boron Steel material. The improvement turning cutting performance, frictional behavior were believe can be perform by having the surface texture on cutting tool. Hence, the choose parameters for laser cutting parameter of this project is based on manufacturing standard chosen. Turning process of AISI 1018 will be done by using this Boron Steel cutting tool in order to find the best surface roughness of material tested. Study of surface roughness using Boron Steel texture cutting tool is a focus in this project.

There are 9 cutting tool of Boron Steel that will be use for laser cutting in engraving the texture. The texture selection on the surface is based from research in literature review. There is some characteristic to be considered during the selection of the texture pattern on cutting tool surface such as the ability of the laser machine to cut the texture pattern. After that, 27 materials of AISI 1018 Low Carbon Steel will be tested on CNC Turning Machine to study the surface roughness.

In this study, non-conventional machining which is CNC Laser Machine and CNC Lathe Machine will be use. This machining process requires direct or determined physical contact of tool and work piece. In another view, non-conventional machining involve machine which are fully automated without human need to control to the function of machine. The machine is controlled by a pre-programmed computer or a robot. High accuracy, better surface and more better result by CNC machining is more prefer usually in the industries because of its advantages over conventional machining.

Turning were broadly utilized the process of manufacturing in engineering industries. The usage of turning operations for metal removal technology has develop rapidly over the previous years and few sectors of engineering have assisted in the technology to accomplish

the aims of this process. The research main point is on the tools feature, parameter of the machining settings. Key factor to achieve these objectives might be in optimum of machining selection conditions because it is a tremendous statistics of variants involved in the process of turning. Different input variables included in the process such as speed of cutting, rate of feed, depth of cut, type of material and features, tool material and geometry, type of cutting fluid. Taguchi method can form an experiment which used to choose the optimum parameter for the turning process. Quality is an important aspect in the turning industry.

1.2 Problem Statement

Manufactures around the world are always exploring innovative procedure in order to get the optimization in manufacturing industries such as optimization in turning process for AISI 1018 Low Carbon Steel. This material standout amongst groups in the Carbon Steel and capable to different shapes type which been used widely in industry. So, variety of parameters have been discovered in machining of the low carbon steel with turning process to get the optimum parameter.

Smooth surface roughness play an important role in engineering industry which produce a high-quality product. A specific degree of surface roughness is also required in order to accommodate wear in of certain parts. Hence, the variety of texture cutting tool is fabricated to study the performance in surface roughness after using in turning process. Lubrication are used for machinery to reduce nature failures and get a result of minimization the amount of heat produced. Amount of heat that is generated by the equipment is transmitted to the oil so that it may be disengaged by a lube oil cooler. Lubricant is a substance that lowers the heat resistance heat and wear when imported as a film between solid surfaces. Adopting a suitable lubricant can expand the life of bearings and machine,

also economical, conserving time and manpower, thus organizing the operations to be more effective and more dependable.

1.3 Project Objective

The objective of this study are:

- To determine the significant of CNC turning process parameter factor that affecting the surface roughness of AISI 1018 Low Carbon Steel.
- To get the optimum parameter for the CNC turning process of AISI 1018 Low Carbon Steel.

1.4 Work Scope

- There are three (3) types of Boron Steel insert tool with the same size and dimension but different surface textures will be used for turning process.
- Material that used is AISI 1018 low carbon steel with the dimension of 100mm length and 20mm diameter, (3) insert tool will be used for each (3) type of surface texture where each of it perform turning machining for the same parameters.
- It will be conduct using Computer Numeric Control (CNC) Lathe Machine to operate turning process.
- Design layout using Taguchi's L9 method and Analysis of Variance (ANOVA).
- The surface texture on insert tool will be employed by using CNC laser cutting machine.
- To evaluate the product surface after turning process been perform by using Surface Roughness Tester.
- Cutting fluid used during machining operation. The experiment is run under wet turning condition, so the turning process have use lubricant or coolant.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The overall goals for this chapter were firstly to establish the importance of the general field of study for this project, overview of previous research on knowledge sharing and information. It introduces the framework for this project that consist the focus of the research.

2.1 CNC Machine

A lathe adhesion has been created for current CNC machine (embedded with rapid prototyping adhesion) by adopting an ideological design. The CNC machine performs on computer interface called CAMSOFT and mechatronic controls and will be utilized similarly as a CNC Lathe after instalment of the respective adhesion. The ideological design stage begins with an idea and different elements of the lathe which designed as adhesion by using CAD modelling and followed by fabrication stage. The lathe adhesion is effectively generated and attach to the CNC machine. Progress system of the CNC Lathe attachment is inspected during machining operation like thread and cutting turning. The CNC machine turns to able in performing multiple functions with the current developed lathe adhesion and the current RP (rapid prototyping) adhesion and able to utilize accordingly by the instalment respective adhesion. For the purpose of meet the higher need to manufacture with high accuracy of complex components in huge amounts, machinery and evolution technological equipment have been evolved. Without much attention, productivity of these components